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RESEARCH OPINIONS IN ANIMAL & VETERINARY SCIENCES

Research article

Tape weighing in the grade calves from artificial insemination of goudali cows using dairy breeds frozen semen in Togo

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Abstract

This study evaluated tape weighing equations in grade breeds obtained from the artificial insemination of Goudali cows using Montbéliarde and Holstein dairy breeds semen. To achieve this, weighing and 3 types of measurements (chest girth, wither height and scapular-ischial length) were performed simultaneously in the morning time, from birth to three months of age at a frequency of 10 days in 46 grade calves in 6 private cattle farms in Togo. Among the three types of measurements, the chest girth and the scapular-ischial length were considered to establish the tape weighing due to their correlation with the weight. The correlation of the weight with the chest girth ($r = 0.956$) or the length scapular-ischial ($r = 0.941$) was higher than the wither height ($r = 0.848$). Therefore, several types of correlation between the weight and the two types of measurements (chest girth and scapular-ischial length) were compared. The tape weighing equation considered for all the animals (male and female) was a linear regression of the predicted weight (y) over the chest girth (x) and the scapular-ischial length (z): $y = 0.006z^2 + 0.722x - 39.798$ with a coefficient of determination $r^2 = 0.896$ and a residual standard deviation $Sy = 2.388$ kg. The use of the tape weighing in growing animals can provide a satisfactory accuracy of the weight without the weighing which is less practical but expensive.

Keywords: Correlations, weight; linear measurements; grade breed; Togo

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Introduction

In Togo, the livestock systems are extensive traditional type focused on the management of natural pastures, fallow land and surface water for watering animals (Adanlehoussi and Adomefa, 2004). In these farms, the Taurine and Zebus breeds are encountered including Goudali breed. Imported from Nigeria, this breed provides good milk compared to these local breeds (Dao, 2013). As part of improving dairy production in Togo, the artificial insemination tests were carried out with the importation of Montbéliarde breed semen (ITRA, 2005). Unfortunately, the outcomes on the growth of grade calves are not available. Meanwhile, the data on the controls on the cattle weighting evolution, particularly that of the growing young

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breeds is important. In addition, the use of cattle scale requires a vehicle, staff and some facilities. This is less practical but expensive (Landais, 1983). An alternative is to use the tape weighing to determine approximately the body weight of the animals through measurements (Larrat et al., 1985). This estimation method is not rigorous as a weighing. However, it is useful because it requires only a light material, minimal staff and small space (Landais, 1983; Larrat et al., 1985). In addition, a satisfactory accuracy can be expected from the use of tape weighing in growing animals (Landais, 1983).

The tape weighing formulae must be established based on the breed, sex and age (Poivey et al., 1980). They were determined in several breeds of Zebu (Maure and Fulani) bulls in West Africa (CIPEA, 1978; Dineur and Thys, 1986) N'Dama (Fall et al., 1982, Planchenault, 1987) and Azawak Zebu (Dodo et al., 2001). This does not seem to be the case in the grade breed from artificial insemination. The objective of this study is to determine the weight of grade calves from birth to three months of age and the tape weighing equations applicable to them.

Materials and Methods

Study zone

This study was carried out in the private dairy breeding cattle farms in South Togo. Six cattle farms were covered by this study: four in the Maritime region and two in Plateaux Region. It covered the farms selected for a study on the genetic improvement of dairy production through the artificial insemination. In these farms, breeders periodically use creep feeding and regularly vaccinate their animals against the trypanosomiasis and gastrointestinal parasites.

This experimental zone takes advantage of a sub-equatorial climate consisted of two rainy seasons, the duration of which varies from March to mid-July for the main rainy season and from mid-September to November for the short rainy season. The rainfall varies from 800 mm on the coasts to 1 600 mm on the mountain with an average temperature ranging from 20° to 35°C (FAO, 2013).

Animals

46 grade calves (Table 1) from crossed Goudali x Montbéliarde known as Goudamont (Fig. 1) and the crossed Goudali x Holstein known as Goudahol (Fig. 2) were the subject of this study.

Table 1: Case Study of Grade calves

	Sex		Type of grade Calves		
	Males	Females	Goudamont	Goudahol	Total
Grade Calves	25	21	19	27	46

Feeding

The calves' feeding was exclusively consisted of the cow's milk until one month of age. After this age, in addition to milk, they are fed with fodder grass with creep feeding composed of salt block and cooking salt until three months of age. The calves were fed on the arrival of cows from pasture in the evening and early in the morning for milk induction. Watering of calves was *ad libitum*.

Veterinary care

Up to three months of age, the calves were vaccinated once against the trypanosomiasis followed by gastrointestinal deworming.

Materials and equipment

A mobile spring scale of 100 kg capacity with a sensitivity of 1 kg was used for weighing calves up to three months of age. Girth tapes of 1.5m were used for the measurements of the wither height, chest girth and scapular-ischial length. The calf's pen was designed using ropes and jute bag.

Measurement and weighing

Three measurements were performed to determine the tape weighing:

- chest girth: heart girth immediately behind the shoulder;
- wither height: vertical distance between the ground and the top of the wither, immediately behind the bump, on the top of the scapula and not on the spiny apophyses of the dorsal vertebrae;
- scapular-ischial length: distance between the tip of the shoulder and the tip of the buttock.

The weighing was carried out in the morning before the watering of the animals and immediately after the measurements. They were recorded in the mornings after feeding the calves when they were immobilized.

Frequency of data collection

The measurements and weighing were carried out by 10 days interval from birth until three months of age corresponding to the age when the weighing are impossible given the scale capacity and the difficulties related to the calves control.

Statistical analysis

The averages and standard deviations of the weight were calculated using Microsoft Excel. The tape weighing formulae were determined using the IBM SPSS statistical software using the linear regression method. The estimated weight (y) was considered as the dependent variable. The independent variables were the chest girth (x) and the scapular-ischial length (z). The different equations were compared based on their coefficient of determination (r^2).

Results

Weights of the grade breeds

The weights of the grade calves from birth to three months of age are relatively higher than those of the grade heifer. The weights from birth to one month of the Goudahol are significantly different ($p \leq 0.05$) than those of the Goudamont; but remain insignificant ($p > 0.05$) from the second month until three months of age (Table 2).

Table 2: Weights of the grade breeds from birth to three months of age

Factors	Birth	1st month (30 days)	2nd month (60 days)	3rd month (90 days)
Male	22.36± 7.35[a]	38.31± 16.08[a]	44.6± 13[a]	56± 5.32[a]
Female	22.05± 6.14[a]	37± 9.59[a]	43.25± 4.53[a]	55± 4.17[a]
Goudamont	20.65± 6.54[a]	31.86± 11.70[a]	44.71± 16.59[a]	55.12± 4.95[a]
Goudahol	23.3± 5.3[b]	37.7± 14.24[b]	44.28± 9.20[a]	56.65± 5.08[a]

The weights of the same column with letters a and b in upper script are significant different ($p \leq 0.05$).

Correlations between the weight and linear measurements

In all the calves (male and female, Goudamont and Goudahol), the weight has increased in the same direction and at approximately the same rate as the chest girth, the wither height and the scapular-ischial length (Fig. 3, 4, 5 & 6). A simple correlation matrix for the four variables was established. The correlations between the four variables ranged from 0.848 to 0.956. The different measurements were strongly correlated with the weight. The correlation was more pronounced with the chest girth ($r = 0.956$) and the scapular-ischial length ($r = 0.941$) than the wither height ($r = 0.848$).

Choice of a formula per grade category

The chest girth and the scapular-ischial length were selected for the determination of the tape weighing formulae because of their higher correlation with the weight. Therefore, several types of connection between the weight (y), chest girth (x) and the scapular-ischial length (z) were compared. Equations from linear regressions having exhibited better precision (a higher coefficient of determination and a lower residual standard deviation) were established based on the variables x and z (Table 3). In the males and females, the weight predicted with the linear regression of y over x and z were very close to the observed weight.

The most frequent non-standard errors (difference between the observed and predicted weights) did not exceed 2.5 kg of body weight and there was no pronounced tendency to underestimate or overestimate the weight predicted (Fig. 7).

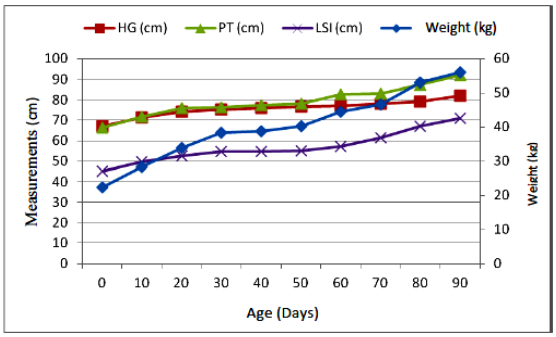

Fig. 3: Evolution of linear measurements and weight in male breeds (n = 25).

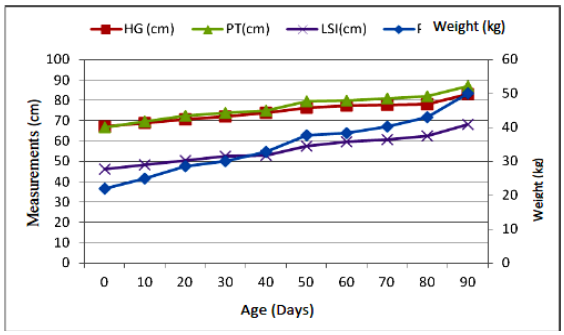

Fig. 4: Evolution of linear measurements and weight in the female breeds (n = 21).

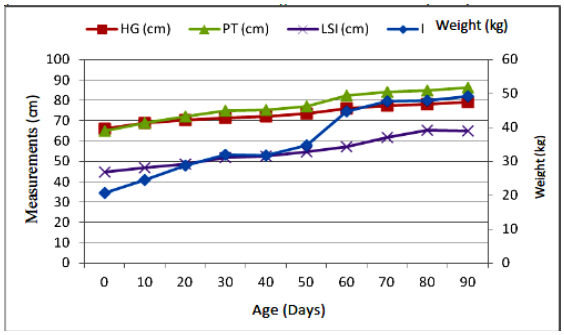

Fig. 5: Evolution of linear measurements and weight in the Goudamont (n = 19).

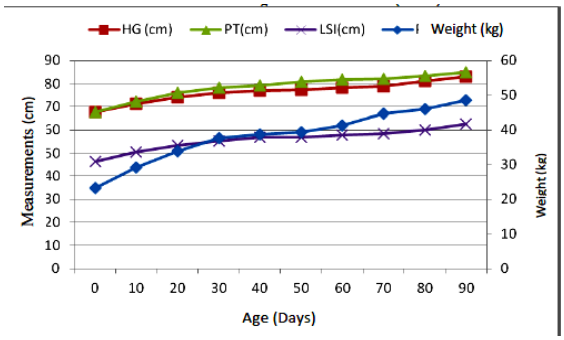

Fig. 6: Evolution of linear measurements and weight in the grade breeds HO (n = 27).

Table 3: Tape weighing equations

Factors		NO	Equations	Coefficient of determination	Residual standard deviation (Kg)
Grade breeds (Goudamont and Goudahol; Male and Female)		46	$y = 0.006z^2 + 0.722x - 39.798$	$r^2 = 0.896$	Sy = 2.388
Sex	Male	25	$y = 0.0732x + 0.605z - 52.175$	$r^2 = 0.967$	Sy = 1.779
	Female	21	$y = 0.14x^2 – 0.778x + 11.689$	$r^2 = 0.994$	Sy = 0.641
Semen used	Goudamont	19	$y = 0.019x^2 – 1.547x + 38.838$	$r^2 = 0.992$	Sy = 0.867
	Goudahol	27	$y = 0.029x^2 – 2.902x + 88.640$	$r^2 = 0.993$	Sy = 0.626

NO = number of observations; y = estimated weight (kg); x = chest girth (cm), z = scapular-ischial length (cm); Sy = residual standard deviation (kg); r^2 = coefficient of determination.

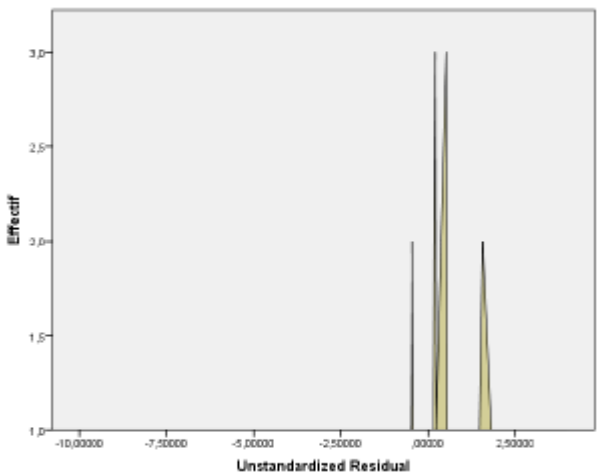

Fig. 7: Non-standard errors frequency between predicted and observed weights (n = 46).

Discussion

The chest girth, scapular-ischial length and wither height are the measurements used in tape weighing due to their correlation with the weight (Poivey et al., 1980; Landais, 1983; Dodo et al., 2001). All the calves considered, the body weight was strongly correlated with the three types of measurements. However, this correlation was less pronounced with the wither height, in accordance with the findings of some authors (CIPEA, 1978; Fall et al., 1982; Dineur and Thys, 1986 Dodo et al., 2001). The measurements having brought more accuracy on the predictive value of the body weight was the measurement of the chest girth as reported unanimously by different authors (Poivey et al., 1980; Fall et al., 1982; Dineur and Thys, 1986; Planchenault 1987; Dodo et al., 2001).

The linear regression of the weight on the chest girth and the scapular-ischial length proved to be the most accurate predictive equation for all the animals.

The tape weighing formula in the form of a linear regression proposed for all the animals in Goudamont and Goudahol grades in this study revealed minor non-standard errors. Tape weighing formulae in the form of linear equations have been proposed for Zebu Maure (CIPEA, 1978) and the N'Dama young bull (Fall et al., 1982). Overall, the error in the weight estimate by the linear equations is higher than the polynomial regression proposed by Dodo et al. (2001). However, according to Symoens and Hounsou in Borgou cattle, the weights below 150 kg and above 250 kg, predicted by the polynomial equations, are closer to the observed weights than those calculated by a linear equation (Symoens and Hounsou, 1991).

In males and all grade breeds, the linear regression with the two variables has been particularly more accurate for the prediction of the body weight of calves. The chest girth and the scapular-ischial length may reflect an aspect of volume and a rough representation of animals in the form of cylinder. This cylindrical form would be more pronounced in males than females. A close connection could be imagined between this volume and the weight. In practice, the measurement of the scapular-ischial length is relatively easy.

The improved accuracy provided by the wither height becomes significant only in adult animals (Landais, 1983). The equation based only on the chest girth has the advantage of being simple, of requiring less work and leading to the establishment of the chest girth conversion tables in directly applicable weight (Planchenault, 1987).

In Côte d'Ivoire, these tables have been grouped in an *Atlas of tape weighing* which was distributed to the field agents. On the monitoring sheet of some research programs, the chest girth is provided in the absence of the weighing and the conversion is carried out using a computer. The nature of the data (measurements or weighing) is mentioned in order to evaluate the level of accuracy or error (Landais, 1983).

The different tape weighing equations considered in the Goudamont and Goudahol grade breeds have covered mainly young animals. With adult animals, the accuracy becomes insufficient due to the level of fattening or physiological state in reproductive females (Landais, 1983). The muscular and fattening conditions modify significantly the nature of the observed connections. In particular, the fatty deposits obey very different laws from those applied to the growth of the other tissues (Sow et al., 1991).

Conclusion

The tape weighing formulae proposed in the Goudamont and Goudahol grade breeds are linear regressions established based on the chest girth and scapular-ischial length. They can be used with very satisfactory accuracy during the weight management of the growing animals.

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References

Adanlehoussi A, Adomefa K (2004) Compte rendu de l'atelier de restitution des résultats de rapport recherche sur l'amélioration de la filière laitière au Togo, ITRA et CIRDES, 27p.

CIPEA (1978) Évaluation des productivités des races bovines Maure et Peulh à la station du Sahel (Monographie n° 1). Niono, Mali, *Cipea*, pp: 91-97.

Dao D (2013) "Étude relative à la formulation du programme d'actions détaillées de développement de la filière lait en zone UEMOA", Annexe 8: rapport Togo, 22p.

Dineur B, Thys E (1986) Les Kapsiki: race taurine de l'extrême-Nord camerounais. Introduction et barymétrie. Revue Elev Méd vét Pays trop 39: 435-442.

Dodo K, Pandey VS, Illiassou MS (2001) Utilisation de la barymétrie pour l'estimation du poids chez le zébu Azawak au Niger. Revue Élev Méd vét Pays trop 54: 63-68.

Domingo AM (1976) Contribution à l'étude de la population bovine des États du Golfe du Bénin. Paris, France, Agence de coopération culturelle et technique, 143 p.

Fall A, Diop M, Sandford J, Wissocq YJ, Durkin J, Trail JCM (1982) Évaluation des productivités des ovins Djallonké et des taurins N'Dama au Centre de recherches zootechniques de Kolda, Sénégal. Addis Abéba, Ethiopie, *Cipea*, 74 p. (Rapport de recherche n° 3).

FAO (2013) 4ème Recensement National de l'Agriculture. Ministère de l'Agriculture, de l'Elevage et de la pêche (MAEP), Direction des Statistiques Agricoles, de l'Informatique et de la Documentation (DSID), document définitif, 51p.

ITRA (2005) Institut Togolais de Recherche Agronomique, productions animales au Togo: situation de référence, 128p.

Landais E(1983) Analyse des systèmes d'élevage bovin sédentaire du Nord de la Côte d'Ivoire. Tome II. Données zootechniques et conclusions générales. Maisons-Alfort, France, Gerdat-Iemvt 411-431 p.

Larrat R, Pagot J, Van Den Bussche J (1985) Manuel des agents techniques de l'élevage tropical. Maisons-Alfort, France, Iemvt- Cirad, 466-468 p.

MAEH (2003) Ministère de l'Agriculture, de l'Elevage et de l'Hydraulique du Togo. Rapport National de l'état des ressources génétiques animales au Togo, 71p.

Moudi B M (2004) Contribution à la connaissance de la fertilité des vaches Holstein et métisses au Sénégal: Cas de la ferme de Niacoulrab. Th Méd Vét Dakar 15.

Planchenault D (1987) Essai d'amélioration génétique des bovins en milieu défavorable. Exemple du ranch de Madina-Diassa au Mali. *Thèse Doct., Université Pierre et Marie Curie*, Paris/Maisons-Alfort, France, Cirad-Iemvt, 307 p.

Poivey JP, Landais E, Seitz JL (1980) Utilisation de la barymétrie chez les races taurines locales de Côte d'Ivoire. Revue Elev Méd vét Pays trop 33: 311-317.

Sow RS, Denis JP, Trail JCM, Thiongane PI, Mbaye M (1991) Note sur la barymétrie comme moyen de sélection indirecte du poids vif chez le zébu Gobra au Sénégal. Revue Elev Méd vét Pays trop 44: 97-100.

Symoens C, Hounsou VEG (1991) Mesures barymétriques chez le bétail Borgou dans le Nord-Est Bénin. Revue Elev Méd vét Pays trop 44: 487-490.